

TAXONOMY AND ETHOLOGY OF A NEW CENTRAL AMERICAN
SPECIES OF ROBBER FLY IN THE GENUS
GLAPHYROPYGA (DIPTERA: ASILIDAE)

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Abstract.—*Glaphyropyga dryas*, from Panama and Costa Rica, is described and illustrated. The genus *Glaphyropyga* Schiner is characterized by species with a very narrow face, a slender third antennal segment with a short to long arista, lack of postscutellar pile, and possession of a gray microvillous shadow in the anteroapical portion of the wing. Known species of *Glaphyropyga* share the habitat preference of *G. dryas* and range from eastern Mexico to southern Brazil. Adults of *G. dryas* are active during the rainy season and inhabit the shaded forest understory, perching on twig tips 0.5 to 2.0 m above ground. Prey records include nine orders of insects, with Diptera, Coleoptera, Hymenoptera, and Homoptera accounting for 94% of recorded captures. The order Zoraptera is reported for the first time as prey of an asilid. Size of prey ranges from 1.1 to 6.5 mm and averages 3.07 mm for 101 measured items. Courtship consists of the male's hovering and bobbing, with hindlegs extended below, to the side of the perched female. Copulating pairs assume a tail-to-tail position on a branch tip.

The tropical forests of Central America possess a very rich and diverse robber fly fauna. Field studies by the authors on Barro Colorado Island, Panama, indicate that more than 70 species of Asilidae occur at this small (15.6 km²), tropical moist forest site (Hespenheide and Fisher, unpublished data). About half of these species are undescribed—a legacy of both the species richness of Neotropical forests and the very limited taxonomic attention so far given to Central American robber flies. An undescribed species of *Glaphyropyga* Schiner is one of the most abundant asilids on Barro Colorado Island. The purpose of this paper is to describe this species and to present observations on the taxonomy and biology of it and of the genus *Glaphyropyga*. The taxonomic portion of this paper was prepared by EMF, the ethological portion primarily by HAH.

Glaphropyga dryas Fisher, **NEW SPECIES**

Figs. 1-6

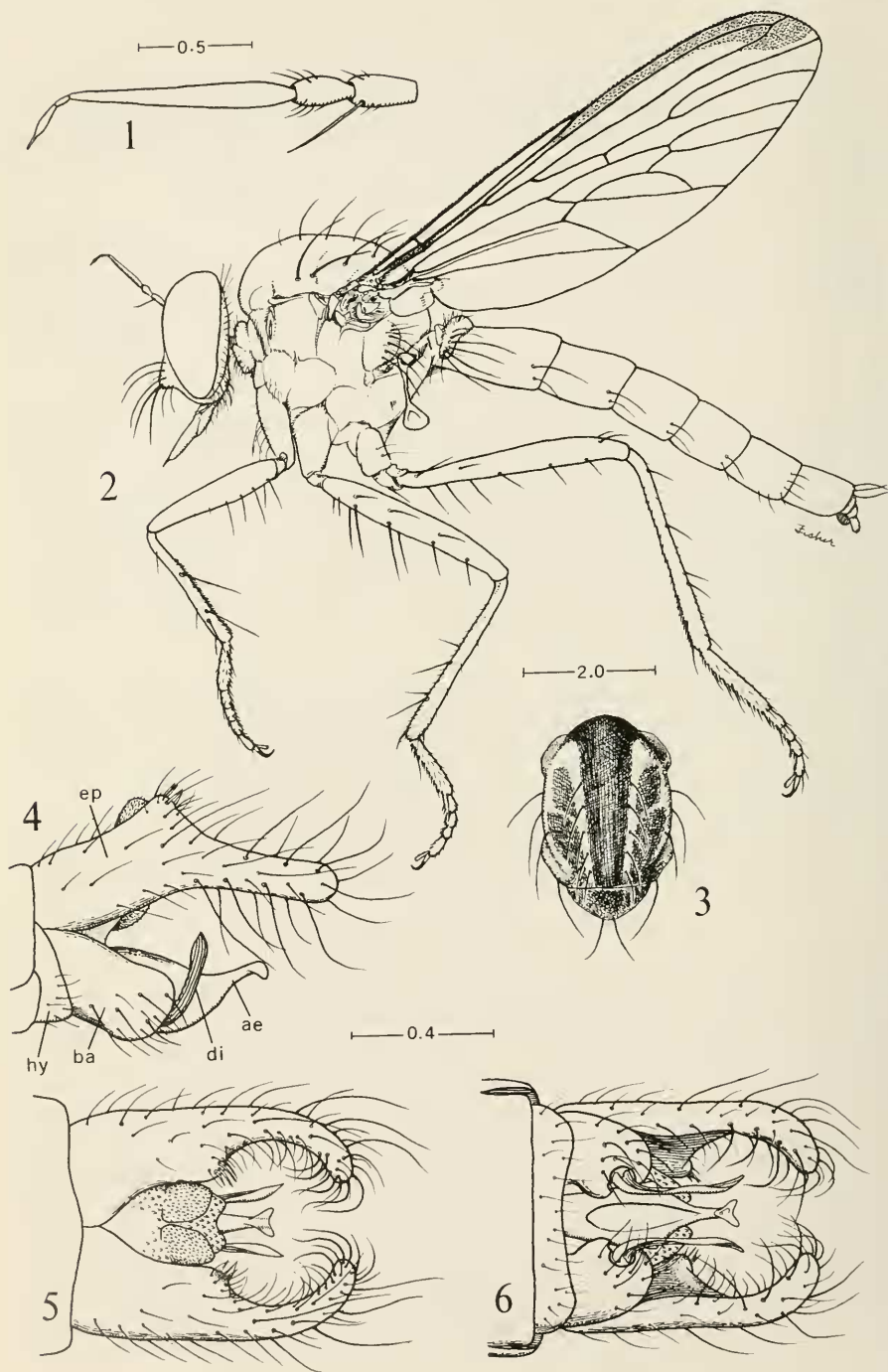
Diagnosis.—A small species, most closely related to *G. himantocera* (Wiedemann), differing from that species as follows: Male with conspicuous, dorsal-median, setigerous protuberance on epandrium; female with a group of 6 apically convergent, black bristles at apex of tergum 7.

Holotype male.—Length 12.1 mm. Head yellowish brown anteriorly, black dorsally and posteriorly. Face $\frac{1}{10}$ width of head at middle, very densely silvery tomentose above, thinly yellowish gray tomentose below at base of proboscis; front with tomentum yellowish brown laterally, black medially; vertex dark brown tomentose, more yellowish posteriorly, a polished black spot anterior to ocellar tubercle; occiput with tomentum mostly gray, dark brown next to vertex; mystax silvery white, with 10 long, prominent bristles on gibbosity, arranged in a triangular fashion—2 vertical rows of 3 slender bristles above, which diverge ventrad, and 2 pairs of strong bristles below on oral margin, the middle pair stoutest—plus 6 short, slender bristles on oral margin; a few short, yellow hairs laterally on frons, a brown pair on ocellar tubercle; slender, subproclinate occipital bristles yellowish dorsally, white laterally and ventrally; beard white. Proboscis black, palpi yellow, the sparse hair white.

Antenna (Fig. 1) 1.8 mm long, 3rd segment about $3\frac{1}{2} \times$ as long as arista plus microsegment; segments 1, 2, and extreme base of 3 brownish yellow, remainder blackish brown (including sub-apical ring on 2); strong ventroapical bristle on 1 and setae on 1 and 2 yellowish white; segment 3 dark brown tomentose dorsally, yellowish brown ventrally; arista glabrous.

Thorax black, yellowish brown posteroventrally on pleurae. Mesonotum (Fig. 3) with tomentum dark brown on broad central stripe (slightly paler along midline) and intermediate spots, golden brown on dorsocentral and lateral vittae, grayish brown on humeri, postalar calli and posterior declivity (latter with median, dark brown spot above scutellum), gray along extreme lateral margins; long, stout bristles black, distributed as follows: 5 pair of dorsocentrals, 2 pair of notopleurals, 1 pair of supraalars, 1 pair of postalars; 5 pair of slender dorsocentrals, 6 pair of anterior acrostichals and very sparse bristles on anterior and posterior declivities all black and short (subequal in length to antennal segment 2); sparse, scattered pile on humeri and lateral margins white. Scutellum gray tomentose, more brownish centrally on disk; very sparse, short diskal pile white, 1 pair stout, long marginal bristles black. Pleurae and postscutellar slopes whitish gray tomentose, with pronotum dorsally and anepisternum posterodorsally brown tomentose; pile short, sparse, white; laterotergal fan of 6 to 8 stout bristles white.

Legs very pale brownish yellow, translucent, the foreleg almost white, except these areas dark brown: Anterodorsal stripe and apical $\frac{1}{4}$ hindfemur,



dorsum of basal $\frac{1}{3}$ and entire apical $\frac{1}{4}$ hindtibia, and apical $\frac{1}{2}$ of 5th segment hindtarsus; very narrow anterodorsal stripe and apical $\frac{1}{5}$ midfemur, and segments 4 and 5 of midtarsus; segments 3 to 5 of foretarsus. Bristles and pile nearly all whitish yellow on pale areas of legs and brown to black on dark areas, but dorsal surfaces of all femora with short, sparse, recumbent black hair and tibiae and tarsi with scattered, minute black setulae; posteroventral surfaces of fore- and midfemora and foretibia with sparse, erect pile about as long as width of midfemur; remainder of vestiture typical for genus. Claws black, with extreme bases red. Coxae yellowish brown, with whitish-gray tomentum and white pile.

Wings (see Fig. 2) 8.9 mm long; membrane very faintly infusate, slightly darker along posterior margin; gray shadow of microvilli extending across anterior $\frac{4}{5}$ of apex of 1st submarginal cell (R_{2+3}). Halter brownish yellow, edges of knob darker.

Abdomen black, narrow lateral and posterior margins of terga 1–5 yellowish brown; terga 1–7 with black areas dark brown tomentose, paler areas of terga 1–5 yellowish brown tomentose; sterna 1–6 grayish brown tomentose, sternum 7 thinly so; narrow lateral margin of tergum 7 and all of tergum and sternum 8 and genitalia polished black; short, recumbent dorsal pile black, longer bristles yellow, ventral pile and bristles yellow. Genitalia as in Figs. 4–6: epandrium near middle with prominent dorsomedian protuberance, which bears at apex a clump of about 6 short, stout bristles; apical $\frac{1}{2}$ of epandrium, beyond protuberance, angled slightly ventrad; gonopods with basistyli rounded apically; hypandrium with apical margin slightly concave; aedeagus reddish brown, visible basal portion with oval-shaped ventral depression; bristles and pile whitish yellow, some recumbent pile at epandrium base black.

Allotype female.—Body length 11.1 mm; wing length 9.3 mm. Similar to male, differing as follows: Face with plane portion pale yellowish and gibbosity grayish white tomentose; 3 pair of dorsal bristles in mystax brown. Antenna with basal 2 segments brown tomentose, with brown bristles and black hair. Mesonotum with anterior acrostichal bristles shorter, subequal to $\frac{1}{2}$ length of antennal segment 2. Legs much darker, chiefly blackish brown, with these areas yellowish: Ventral margins of basal $\frac{2}{3}$ of all femora (extending onto dorsum at bases of mid- and hindfemora), dorsum of midtibia from before middle to apical $\frac{3}{4}$, and foretibia except apical $\frac{1}{5}$ and narrow posterior stripe; vestiture nearly all black, except large bristles at

Figs. 1–6. *Glaphyropyga dryas*. 1, Antenna of female. 2, Lateral view of female. 3, Mesonotum and scutellum. 4–6, male genitalia. 4, Lateral view (ep = epandrium; hy = hypandrium; ba = basistylus; di = distylus; ae = aedeagus). 5, Dorsal view. 6, Ventral view. Scales in mm.

base of hindfemur and "cleaning pads" on fore- and hindlegs yellowish. Coxae with some anterior bristles brown. Abdomen with segments 7 and 8 and narrow lateral margin of tergum 6 polished black; apex of tergum 7 with file of 6 black bristles which converge and cross apically. Ovipositor with short, yellow pile.

Distribution.—Known from the Isthmus of Panama and Cartago and Heredia Provinces, Costa Rica.

Type specimens.—Holotype ♂ (USNM): Barro Colorado Island, Canal Zone, Panama, 11/13 June 1976 (E. M. Fisher). Allotype ♀ (USNM), same data as for holotype. Paratypes (55 ♂, 113 ♀). PANAMA: Canal Zone: Barro Colorado Island, 43 ♂, 63 ♀, 9 July to 11 Sept. 1974, 2/3 Aug. 1975, 8/20 June 1976, 10 May, 29 July 1977, 9 July to 12 Aug. 1978 (H. A. Hespenheide and/or E. M. Fisher); 9 km NW Gamboa, 3 ♀, 4/12 Aug. 1975 (E. M. and J. L. Fisher); Madden Forest, mi 3.5, 2 ♂, 4 July 1977 (H. A. Hespenheide); Chiva Chiva Rd., 8 air km N Fort Clayton, 2 ♀, 23 July 1978 (E. M. Fisher, N. E. Woodley, A. Worthington); 1 km E Farfan, 4 ♂, 20 ♀, 31 July, 11 Aug. 1975 (E. M. Fisher); 9 km NW Gatun, 2 ♀, 9 Aug. 1975 (E. M. Fisher); Devil's Beach, 5 km W Fort Sherman, 1 ♂, 2 ♀, 9/10 Aug. 1975 (E. M. Fisher). Panama Prov.: Bayano R. Bridge on Hwy 2, nr Chepo, 1 ♀, 12 Sept. 1974 (H. A. Hespenheide); Pacora, Sta. C, 1 ♂, 1 ♀, 9 July 1951 (F. Miller); Cerro Azul, N of Tocumen, 1 ♀, 7 June 1958 (W. J. Hanson); Cerro Campana, 800–860 m, 4 ♂, 18 ♀, 26 June, 13 July 1977 (H. A. Hespenheide), 17 July, 27 July, 19 Aug. 1978 (E. M. Fisher, N. E. Woodley).

Paratypes to be deposited in the National Museum of Natural History, Washington, D.C. (USNM); California Academy of Sciences, San Francisco; Natural History Museum of Los Angeles County, California; American Museum of Natural History, New York; University of California, Riverside; British Museum (Natural History), London; Naturhistorisches Museum, Vienna; the collections of the authors and Joseph Wilcox, and at other appropriate institutions and collections.

Other specimens examined.—COSTA RICA: Cartago: 5 km E Turriabla, C.A.T.I.E., 6 ♂, 36 ♀, 21/22 July 1975 (E. M. and J. L. Fisher); Turriabla, 1 ♀, 9 July 1965 (G. R. Noonan). Heredia: Finca La Selva, 3 km S Puerto Viejo, 2 ♀, 23/25 July 1976 (E. M. Fisher, H. A. Hespenheide).

The Costa Rican specimens agree with the Panamanian material in all respects but are not being made paratypes.

Discussion.—The specific name is derived from the Greek *Dryas* (f.—a wood nymph) and refers to the habitat of this species.

Variation among available specimens of *G. dryas* is very slight. Most notable are differences in body length, males ranging from 10.3 to 13.0 mm long, females from 10.2 to 13.2 mm. Many males have the lateral margins of tergum 6 narrowly polished, instead of entirely tomentose. About a quarter of the female specimens have a faint trace of the oval white spot near

the apex of the first submarginal cell, a characteristic found in *G. himantocera* and several other *Glaphyropyga* species; however it is never as distinct and opaque in *G. dryas*.

The shape of the male epandrium and the file of bristles on tergum 7 of females are characteristics unique to *G. dryas*. The combination of the following characters are also useful for distinguishing this species from the other known (described and undescribed) species of *Glaphyropyga*: Small size (10.2 to 13.2 mm body length); form of the mystax (four stout bristles in-line along oral margin, six slender bristles above, in two dorsally converging rows of three each, leaving a triangular area in the center of the gibbosity bare of long bristles); arista and microsegment together being less than $\frac{1}{3}$ the length of antennal segment 3; wing with shadow extending exactly to posterior $\frac{1}{5}$ of first submarginal cell and, in females, lacking a conspicuous, oval, opaque white spot. *Glaphyropyga dryas* is most similar to the Brazilian *G. himantocera*, which is a larger species (14.5–17.0 mm long; Carrera, 1945) and has non-protuberant, non-angulate epandria (parallel sided in lateral view). Carrera (1950) described *G. aristata* from Barro Colorado Island; it is similar in size and form to *G. himantocera* but has the arista nearly as long as the third antennal segment.

GENERAL REMARKS ON THE GENUS *GLAPHYROPYGA*

Taxonomy.—The genus *Glaphyropyga* was placed in the Asilinae by Hull (1962) and the Apocleinae by Papavero (1973). It may be recognized by the slender form of its species, their sparse pilosity and dark brown dorsal tomentum, the very narrow face with ventrally placed gibbosity and mystax, the narrow and elongate third antennal segment, and the lack of postscutellar pile. In addition, all known species of the genus have a gray microvillous shadow in the apical half of the subcostal cell of the wing (and usually the marginal and first submarginal cells also).

Hull (1962) emphasized the very short arista of the type-species, *G. himantocera*, as a means of recognizing the genus. Earlier Hull (1958) described the genus *Opopotes* to include a new species, *O. attenuatus* Hull, with an elongate arista (in describing *Opopotes*, Hull evidently overlooked Carrera's previous description of *G. aristata*, as this species obviously would fit his concept of the new genus). Papavero (1973) listed *Opopotes* as a synonym of *Glaphyropyga*; we agree with this synonymy. *Tapinostylus* Enderlein is also synonymous with *Glaphyropyga* (Hull, 1962; Martin and Papavero, 1970). Species of *Glaphyropyga* have also been incorrectly placed in *Senoprosopis* Macquart, a quite unrelated genus, but one whose members have a similarly slender habitus. Curran's figures 53 and 137 (Curran, 1934: 170, 180), identified as *Senoprosopis* sp., are actually of *G. dryas*.

As now understood, *Glaphyropyga* contains species with an arista length (including the short, basally attached microsegment) of about $\frac{1}{7}$ to sub-

equal the length of the third antennal segment. Although the species of *Glaphyropyga* vary as to length of arista, they are otherwise a taxonomically and biologically cohesive and well characterized group. An arbitrary division of those species with a longer arista into another genus is unwarranted.

Six species of *Glaphyropyga* are currently known in the literature, and the genus is reported to range from Brazil to Costa Rica (Martin and Papavero, 1970). In addition to *G. dryas*, at least eight undescribed Middle American species are on hand. One of these occurs in the cloud forests of Hidalgo, Mexico, some 2000 km northwest of Costa Rica. We anticipate the discovery of many additional species in the genus, especially in South America.

Biology.—Probably all species of *Glaphyropyga* (11 species have been observed by us in the field) occur in well forested habitats at low to moderate elevations. The genus is apparently restricted to older second growth and "primary" tropical forest, and is absent from badly disturbed forest and early-successional second growth areas. *Glaphyropyga* species invariably perch on slender, bare tips of branches, at heights of one to several meters. They are seldom found in open, fully sunlit areas and instead prefer the partial to complete shade of the forest understory. Edges of trails and openings in the understory with abundant, but always indirect, light seem to be optimal habitat. On very cloudy or rainy days they may be seen on perches in clearings, and some species are quite active during rains.

ETHOLOGY OF *GLAPHYROPYGA DRYAS*

Microhabitat and foraging behavior.—*Glaphyropyga dryas* has been observed over most of Barro Colorado Island, and is the most common robber fly of the forest interior (Hespenheide and Fisher, unpublished data), accounting for about 25% of all flies observed in trailside censuses. Collection and observation records range from 10 May to 11 September and indicate that this species is active only during the rainy season, which on Barro Colorado Island is typically from early May through mid-December (Croat, 1978). For the small number of flies for which perch characteristics were recorded, most were observed in closed-canopy situations, but a significant proportion were also observed in the vicinity of sunflecks or at the shaded margins of larger openings created by fallen trees. Of 40 flies for which perch type was recorded, 36 were on the tips of bare twigs of understory shrubs or fallen branches, 2 were on tips of leaves, and 2 on vine tips or tendrils. Of 27 recorded perch heights, 3 were at or below about 0.5 m above ground, 12 between 0.5 and 1.5 m, 10 between 1.5 and 2.0 m, and 2 above 2.0 m. These heights undoubtedly reflect the bias of our observational method toward flies at or near eye level, but they do differ significantly from those of some of the other typical forest understory robber fly species. Because a portion of our recorded perch sites and heights were of unusual

Table 1. Sizes of prey taken by *Glaphyropyga dryas*.

Taxon	Number of prey		Mean (mm)	±SD	Range
	Taken	Measured			
Coleoptera	32	31	2.63	1.053	1.1–5.9
Diptera	36	28	2.86	1.048	1.4–5.3
Hemiptera	2	2	4.15	2.899	2.1–6.2
Homoptera	15	13	4.18	1.769	1.3–6.5
Hymenoptera	21	20	3.28	1.192	1.7–5.4
Isoptera	1	1	2.70	—	—
Lepidoptera	4	4	3.65	1.493	1.7–5.2
Psocoptera	1	1	1.90	—	—
Zoraptera	1	1	1.20	—	—
Total	113	101	3.07	1.308	1.1–6.5

or extreme situations, the overall qualitative microhabitat of the species can be characterized as shaded forest understory, with preferred perches being twig tips between 1.5 and 2.0 m above ground.

In addition to foraging sites, we also collected 113 prey items from or together with flies. These represented nine orders of insects, of which Diptera (36 prey, 32%), Coleoptera (32, 29%), Hymenoptera (21, 18%), and Homoptera (15, 14%) predominated. The following taxa were included among these: COLEOPTERA: Cerambycidae (1), Chrysomelidae (3), Curculionidae (1, Cossinae), Phalacridae (1), Rhynchitidae (1), Scarabaeidae (1), Scolytidae (8), Staphylinidae (5), undetermined (11). DIPTERA: Ceratopogonidae (1), Culicidae (1), Drosophilidae (2), Empididae (2), Mycetophilidae (5), Phoridae (5), Psychodidae (1), Sciaridae (15), Sphaeroceridae (1), Stratiomyidae (1), Tipulidae (1), undetermined (1). HEMIPTERA: Cydnidae (1), Lygaeidae (1). HOMOPTERA: Achilidae (2), Cercopidae (1), Cicadellidae (5), Delphacidae (2), Kinnaridae (?), 2), Meenoplidae (?), 1), Fulgoroidea (1), undetermined (1). HYMENOPTERA: Formicidae (19, all reproductives, including the following taxa: *Azteca* sp. ♂ (1), *Myrmelachista* sp. ♂ (2), *Pachycondyla* sp. ♂ (3), *Paratrechina* sp. ♀ (1); Ponerinae genus A ♂ (1), genus B ♂ (1), genus C ♂ (2); *Solenopsis* sp. A ♂ (1), sp. B ♀ (1), sp. C ♀ (1), sp. D ♀ (1)), Tiphidae (1), undetermined (1). ISOPTERA: undetermined (1). LEPIDOPTERA: undetermined moths (4). PSOCOPTERA: undetermined (1). ZORAPTERA: Zorotypidae (1). Of these, the zorotypid is especially noteworthy, apparently being the first record of this infrequently-collected group of insects as prey of an asilid. Sizes of these prey are presented in Table 1.

Courtship and mating behavior.—Courtship behavior was observed by both of us in detail on separate occasions, by EMF on 12 June 1976 between 10:20 and 10:40 h on a sunny day, and by HAH on 23 June 1977 somewhat

before noon, in both instances along William Morton Wheeler trail between the 1400 and 1600 m posts. Courtship was also informally observed and photographed by HAH on other occasions in early July 1977.

Display sites were at typical forging sites, in the understory of closed-canopy forest and (on 23 June 1977) at a shaded broken-canopy site at a partially-overgrown treefall. In all cases females were observed perched on twig tips at heights of 1.5 to 2.0 m above ground. Males hover to the right or left side of the female at the same height, on an axis perpendicular to her, and at a distance of 1-3 cm. Although generally constant in position, the male moves slowly toward and away from the female over a range of 1-3 cm and oscillates vertically over a range of a few mm with an intensity that varies from slow (usually) to very rapid or agitated. While hovering the male holds the fore- and midlegs folded in toward the thorax, fully extends the hindlegs ventrally and occasionally rubs the hindtarsi together. The position of the hindlegs is significant with respect to their coloration, especially as seen by the female; only the whitish-yellow color would be visible to the female as the dark areas would be oriented away from her. Because the forelegs would also show only yellow and all the coxae are very pale, the male would be perceived as a bobbing, pale object against the relatively dim and therefore dark understory background.

Copulation is attempted by the male 1 to 3 times per minute by striking the female from the side and attempting to couple. No successful copulation was seen by us. Females would either leave the perch, and thus end the courting sequence, or fly out 2-3 cm toward the male in a manner similar to a sally for a prey item, although over a much shorter distance than typical. After a few to several minutes of unsuccessful courtship, the male flies off to a nearby perch by means of an erratic, bobbing flight, although with no audible sounds. After an interval of a few minutes, the male may again court the same female.

On 12 June 1976, a pair of *G. dryas* was seen *in copula* shortly afterwards and close by the pair observed courting, but evidently not the same individuals. The two flies were in a tail-to-tail orientation with the female at the tip of the branch facing outwards and the male behind her and facing away.

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